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PROBLEMS OF RURAL RADIOFICATION AND TELEVISION

The All-Union Scientific Session devoted to Radio Day, held in Moscow 5 - 9 May, was sponsored by the All-Union Scientific-Technical Society of Radio Engineering and Electrical Communication imeni A. S. Popov together with the Ministry of Communications, the Ministry of Communication's Equipment Industry, and the Committee on Radiofication and Radio Broadcasting under the Council of Ministers USSR. The session was attended by representatives of scientific research institutes, higher educational institutions, communications enterprises, and other organizations from Moscow, Leningrad, Kiev, Khar'kov, Gor'kiy, and other cities. The work of the session was devoted primarily to problems of rural radiofication and television.

In his report, "The Basic Problems of Rural Radiofication in the Near Future," A. S. Severov, head of the Central Radiofication Administration of the Ministry of Communications, revealed that in 1949 the general level of radiofication was 40 percent higher than the prewar level. He noted that several good models of a low-cost alternating-current receiver have been released by the Ministry of Communications Equipment Industry (the three-tube receivers of the Aleksandrovskiy Plant and the two-tube Ogonek receiver. These receivers satisfy the requirements for a low-cost rural radio and will be widely used in the radiofication of villages having an alternating-current source. The battery Rodina and Iskra receivers do not satisfy these requirements. Severov stated that the efficiency of loudspeakers has a decisive influence on rural radiofication. The economical loudspeaker which Ananiyev designed using Rochelle salt monocrystals has an efficiency of about 60 percent and creates an acoustic pressure of 2-2.5 bars at a distance of one meter along the loudspeaker axis with a power consumption of 5 millwatts.

The most widely used method for rural radiofication is that of radio transmitting-receiving public-address units. The Ministry of Communications has recently conducted an experiment in laying underground lines using cables with polyvinyl chloride insulation. These lines have high operational qualities and may replace overhead lines. The cable-layer constructed from Brodskiy's (Voroshilovgrad Oblast) suggested design has passed preliminary tests

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and should reduce cable-laying expenses considerably. It has been found that when populated points are separated by great distances, it is very efficient to install small receiving public-address units (power of 1-2 volt-amperes each) supplying 35-50 loudspeakers at each point. These methods of rural radiofication may be supplemented by the possibility of using lighting circuits for transmitting radio broadcasts, and also intrarayon telephone circuits for remotely supplying and controlling low-power kolkhoz receiving public-address units. In conclusion, Severov noted the necessity for concentrating rural radiofication problems in one organization.

At the same session, B. N. Mozhzhevelov, board member of the Ministry of the Communications Equipment Industry, submitted a report, "The Radio Industry and Rural Radiofication." Mozhzhevelov also discussed loudspeakers, since they are the basic link in determining the efficiency of all installations. Mozhzhevelov recommended that "Rekord" type loudspeaker be replaced by dynamic speakers (for example, of the Oktav type produced by the Leningrad Plant imeni Kalinin), since the former has not proven satisfactory in production costs, sensitivity, and quality. Mozhzhevelov also reported that the vacuum-tube industry has finished testing production models and is preparing for mass production of a new series of miniature tubes. The importance of selecting the power supply was emphasized. In particular, he stressed the need for analyzing and comparing systems for supplying a 3-watt receiving public-address unit suggested by a number of enterprises of the Ministry of the Communications Equipment Industry -- i.e., wind-driven generators, ordinary generators, vibrators -- with the system recommended by the Ministry of Communications using only filament and plate batteries (without a vibrator).

At the concluding session on 9 May, B. L. Kleyster, Doctor of Technical Sciences, submitted a report on the subject, "New Television Equipment of the Moscow Television Center." The resolutions of the session noted that a great deal of progress in television has been made, as attested to by the test transmissions of the Moscow Television Center with 625 lines per frame and of the Leningrad Television Center with 421 lines per frame and by the production of new television receivers.

The remainder of the session's work was divided into the following separate sections: receiving apparatus, television, radio measurements, transmitting apparatus, radio broadcasting, electroacoustics and sound recording, electromagnetic oscillations, radio methods, and wire communications.

In the section on receiving installations, most of the reports submitted dealt with methods of eliminating noise in receivers. In his report, "Noise Resistance of Communications using Impulse-Code Modulation," S. V. Borodich pointed out that this type of modulation may find wide application in multichannel ultrahigh-frequency communication lines. In his report on wide-band-tuned amplifiers, A. A. Kolosov discussed the following problems: a) maximum band width, maximum amplification, and the optimal number of stages for the basic tuned amplifier circuits; b) noise bands of multistage wide- and narrow-band amplifiers; and c) conditions of self-excitation and conditions for stable operation of wide-band amplifiers.

In the television section, M. I. Krivosheyev submitted a report on the subject, "Electrical Testing Methods for Iconoscopes." Krivosheyev discussed various methods and circuits for measuring the basic parameters of iconoscopes and gave experimental results. In his report, "The Use of Frequency Modulation for Television Retransmission Lines," Engr S. V. Novakovskiy pointed out the advantage of using frequency modulation for television portable retransmission lines operating on frequencies of 6,000-10,000 megacycles. Ya. A. Ryftin also submitted a report, "Evaluating the Resolving Power of Television Transmitting Tubes."

In the section on radio measurements, S. A. Ginzburg, Candidate of Technical Sciences, submitted a report entitled, "The Use of Nonlinear Bridges in Communications Engineering," in which he discussed alternating-current or direct-current nonlinear bridges with inertial nonlinear elements (ballast tubes, incandescent lamps, thermistors) which are used as regulators or voltage indicators. G. D. Burdun, Candidate of Physicomathematical Sciences, submitted an interesting report entitled, "Measuring Dielectric Constants and Dielectric Losses in Solid Dielectrics Using Centimeter Waves." The measurements were conducted with the aid of a measuring wave guide with a short-circuited end and a measuring wave guide line furnished with an additional micrometric unit which increased the accuracy of the reading. A plate of the dielectric to be studied was placed in the short-circuited end. The wave length in the wave guide and the distance of the first minimum from the reflecting side of the dielectric specimen were determined from the standing-wave minimums. On the basis of this data, the dielectric constant and tangent of the loss angle were calculated. Several solid dielectrics used in high-frequency techniques (polystyrol, plexiglass, ebonite, radio porcelain, ultra-porcelain, etc.) were tested experimentally at wave lengths of 3.2 centimeters and 1.6 centimeters.

In the section on transmitting installations, Prof B. P. Terent'yev submitted a report, "Operation and Design of the Reactance Modulator Tube in the Exciter of an FM Transmitter," in which he set forth the characteristics required of the reactance tube and the exciter circuit for obtaining large frequency deviation. Reports were also submitted by A. F. Gikis on the desi[illegible] of circuits supplying polyphase rectifiers, and by Yu. A. Katsman on a method of calculating the parameters of transmitting tubes.

Three reports were submitted in the section on radio broadcasting: I. S. Azarkh, "Multiprogram Broadcasting by Carrier Frequencies on Wires"; P. V. Anan'yev, "A Low-Power Third-Class Speaker Using Little Power"; and V. S. Kissel'gof, "An Installation for Shop Control of Loudspeaker Production." Seven reports were submitted in the section on electroacoustics and sound recording, including A. S. Sheyn's "A Piezoelectric Audio Oscillator." The oscillator develops 100-200 milliwatts of power at an electromagnetive force up to 150-200 volts. The total weight, with the mounting, is 170 grams. The oscillator output is sufficient to activate a sensitive relay with a copper-oxide rectifier and may be used in various automatic and telemechanic installations and in measuring techniques -- for example, in bridge circuits as a current source.

G. V. Kisun'ko's report, "Wave Guide Equations," submitted in the section on electromagnetic oscillations, showed that the general form of the theory of wave guides of arbitrary transverse cross section, which is similar to the theory of long lines, or Kirchoff's equations in circuit theory, may be developed by transforming Maxwell's equations into equations for the coefficients of field resolution by means of a Fourier series in orthogonal eigenfunctions. These transformations are similar to those the author used earlier in the theory of cylindrical wave guides.

In his report, "Stability of Synchronization of Two Oscillators Using Electromagnetic Coupling," G. N. Rapoport, Candidate of Technical Sciences, discussed an experimental study of the dependency of the frequency and phase difference on the distance between two oscillators (for a wave length of 50 centimeters) with electromagnetic coupling. Experimental studies established the presence of a series of regions of stable in-phase and out-of-phase operating conditions, separated by intervals of coupling hysteresis. He obtained the solution of a system of integro-differential equations by the method of small parameters. The introduction of the wave-coupling operator (S. I. Tetel'baum, Corresponding Member, Academy of Sciences Ukrainian SSR) reduced the problem to the study of the stability of synchronizing two oscillators, coupled through

a complex resistance, whose modulus decreases, while the phase increases, the distance. For ordinary oscillators, the given range for the intervals of coupling hysteresis is about one percent of the wave length for distances between the oscillators of the order of twice the wave length; the width of successive coupling hysteresis intervals is inversely proportional to the distance.

Ya. Z. Tsypkin, Doctor of Technical Sciences, submitted a report, "Transient and Steady-State Processes in Circuits with Pulse Action." Studies of transient and steady-state processes in circuits which are subjected to the action of amplitude-modulated sequences of pulses are usually conducted by the graphic method. This method is very cumbersome and inaccurate, and is unsuitable for studying steady-state processes or the relationship between circuit behavior and the circuit parameters. Tsypkin attempted to obtain theoretical formulas to define transient and steady-state processes in the closed form; these formulas would relate circuit behavior to the circuit parameters. The formulas obtained are functions of the number of impulses and the time intervals. Examples were given of the use of these formulas in actual circuits (simple RL and RC circuits, audio-frequency, amplifiers, inverters).

In his report, "Transformation of the Fundamental Wave of a Coaxial Line Into a Wave of Type Eo,n' in a Circular Wave Guide," Engr M. V. Mal'skiy set forth the theory of excitation of a circular wave guide by the electromagnetic field of the fundamental wave of a cylindrical coaxial cable, whose inner conductor was placed on the axis of the wave guide and terminated by a concentric circular disk. The tangential component of the electric field vector on the geometric surface of the circular slot between the disc and the wave guide was found by solving a Fredholm-type integral equation. The problem discussed was solved for the case of ideally conducting metallic surfaces and an infinitely thin disk. In order to ex[illegible] the areas of application of the formulas derived, a correction was introduced which allowed for the finite thickness of the disk. The results obtained were presented in the form of simple formulas and graphs.

In the section on radio methods, three of the four reports submitted dealt with high-frequency induction equipment for drying wood. The fourth report, "Measuring Negative Resistance of Vacuum Tubes in Transitron Operation," submitted by Engr P. P. Klimentov, dealt with methods for obtaining and measuring negative resistance, and analyzed the results of measuring the negative resistance of vacuum tubes under dynamic conditions. In conclusion, Klimentov suggested possible applications of the negative resistance of transitrons, i.e., for amplitude selection and as a phase-shifting device.

In the section on wire communications, the reports submitted included: I. V. Koptev's "General Theory of Electric External and Mutual Effects on Communications Circuits," N. N. Akinfiyev's "Determining the Length of Amplified Sections for a High-Frequency System of Symmetric Cables Without Loading Coils," and O. P. Galkina's "A Grapho-Analytical Method of Consecutive Approximations for Calculating the Parameters of Dipoles Containing Effective Resistance." The fourth report, submitted by E. V. Zelyakh, dealt with the calculation of losses in narrow-band quartz-crystal filters. Zelyakh noted that in most works dealing with quartz-crystal filters, the losses in quartz-crystal resonators have not been taken into consideration. These losses affect the characteristics of narrow-band filters considerably. Together with Engr Ya. I. [illegible]slikin, Zelyakh worked out a method for calculating the operating attenuation of a narrow-band filter made up of condensors and quartz-crystal resonators, taking into account the losses in these elements. This method is a refinement of an original method published by them in 1937.

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